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GEOLOGICAL NOTES

SIGNIFICANCE OF INITIAL DAILY PRODUCTION OF WELLS IN BURBANK AND SOUTH BURBANK OIL FIELDS, OKLAHOMA[1]

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When the initial daily yields of all oil wells in the Burbank and South Burbank fields of Osage and Kay counties, Oklahoma, are plotted on a map (Fig. 1) it is found that the wells with large initial daily yields lie in long, narrow belts. These belts parallel the curved eastern margins of both the reservoir sand bodies and the oil pools; and in the northern part of the Burbank field they curve westward so that they nearly parallel the northern margin of that field.

A belt about a mile wide, extending through Secs. 22, 23, and 24, T. 27 N., R. 5 E., and Secs. 19 and 29, T. 27 N., R. 6 E., contains the most prolific oil-bearing sand in the Burbank field. Within this belt there are 17 tracts of 160 acres each that by the end of 1940 had yielded a total of 35,223,701 barrels, a little more than one-sixth of the total amount produced from the entire Burbank field. Wells within these tracts have had both large initial and large total yields.

An earlier investigation[3] of the thickness of the reservoir sand bodies of the two fields showed that the reservoir sand bodies are large lenses ranging in thickness from a feather edge to more than 100 feet and that they contain narrow curved belts of thick sand. The trends of these belts of thick sand are similar to the trends of the belts of large-yielding oil wells.

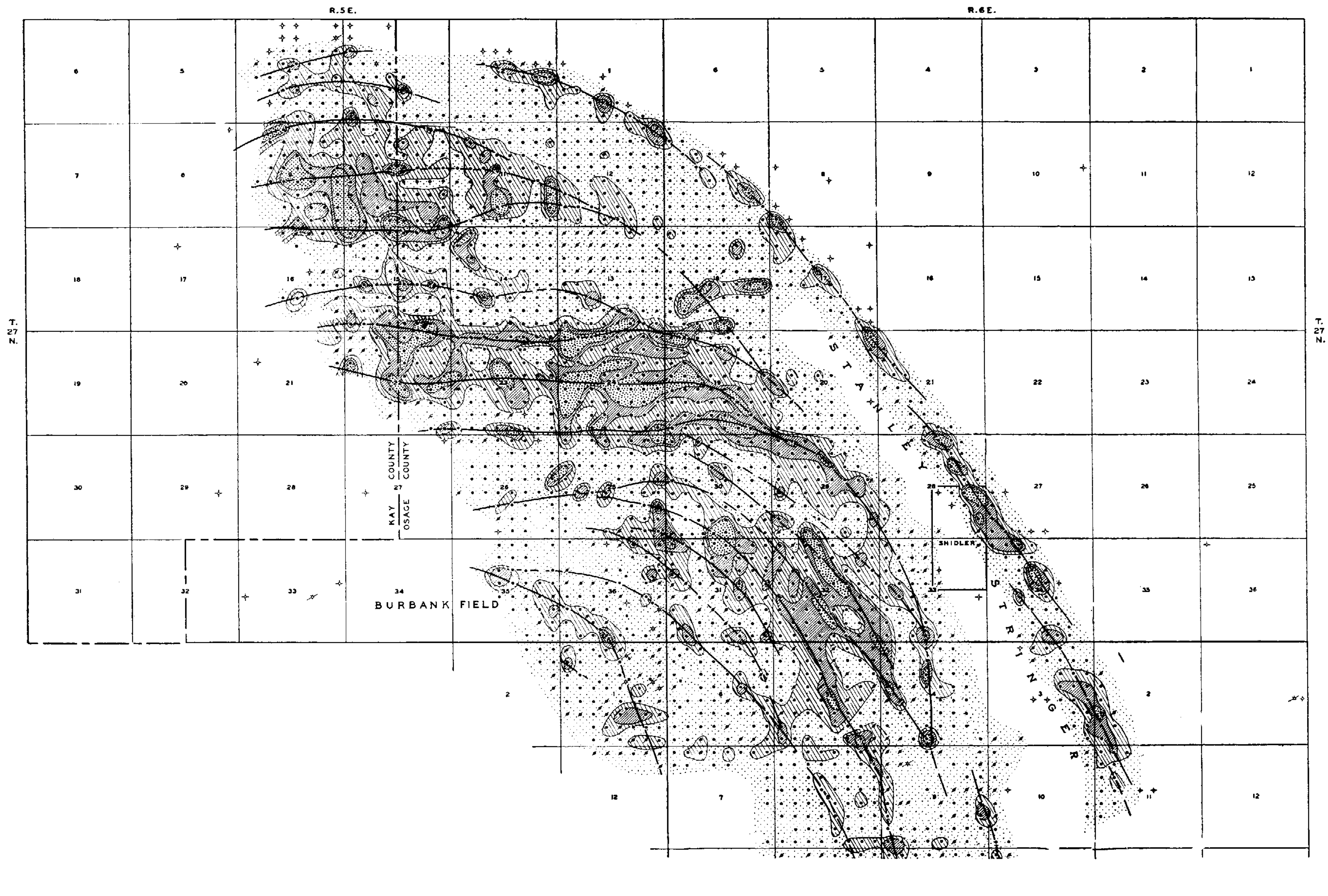
It was pointed out in the earlier report that (1) the ridges of thick sand in the Burbank and South Burbank fields appear to represent beach-growth ridges in offshore bars that were formed on the western shore of the Pennsylvanian sea; and (2) that the sand bodies grew progressively eastward and northward as a series of overlapping beaches beginning at the southwest margin of the Burbank field.

Narrow sand bars parallel with the shoreline are built by waves and longshore currents. The margins of a bar feather out into the

[1] Manuscript received, April 11, 1941. Published by permission of the director of the Geological Survey, United States Department of the Interior.

[2] Federal Building.

[3] N. W. Bass, Constance Leatherock, W. R. Dillard, and L. E. Kennedy, "Origin and Distribution of Bartlesville and Burbank Shoestring Oil Sands in Parts of Oklahoma and Kansas," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 21, No. 1 (January, 1937), pp. 30-66.


R.5E.
R.6E.
T.
27
N.
STANLEY STRINGER
SHIDLER
KAY COUNTY
OSAGE COUNTY
BURBANK FIELD

Areas in which the initial daily yields of the wells were less than 500 barrels

Areas in which the initial daily yields of the wells ranged from 500 to 1,000 barrels

Areas in the Burbank field in which the initial daily yields of the wells ranged from 1,000 to 1,500 barrels, and areas in the South Burbank field in which the initial daily yields ranged from 1,000 to 2,000 barrels

Areas in the Burbank field in which the initial daily yields of the wells exceeded 1,500 barrels, and areas in the South Burbank field in which the initial daily yields exceeded 2,000 barrels

Heavy curved lines delineate belts of wells that have had large initial daily yields and, as interpreted herein, delineate belts of overlapping sand bars that collectively constitute the reservoir sand bodies

Base map compiled from General Land Office plats

Oil and gas wells and initial daily yields of oil wells compiled from maps of Osage Indian Agency

- Oil well
- Abandoned oil well
- Gas well
- Abandoned gas well

MAP OF THE BURBANK AND SOUTH BURBANK OIL FIELDS, OSAGE AND KAY COUNTIES, OKLAHOMA SHOWING INITIAL DAILY YIELDS OF WELLS.

SCALE

0 ½ 1 2 MILES

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

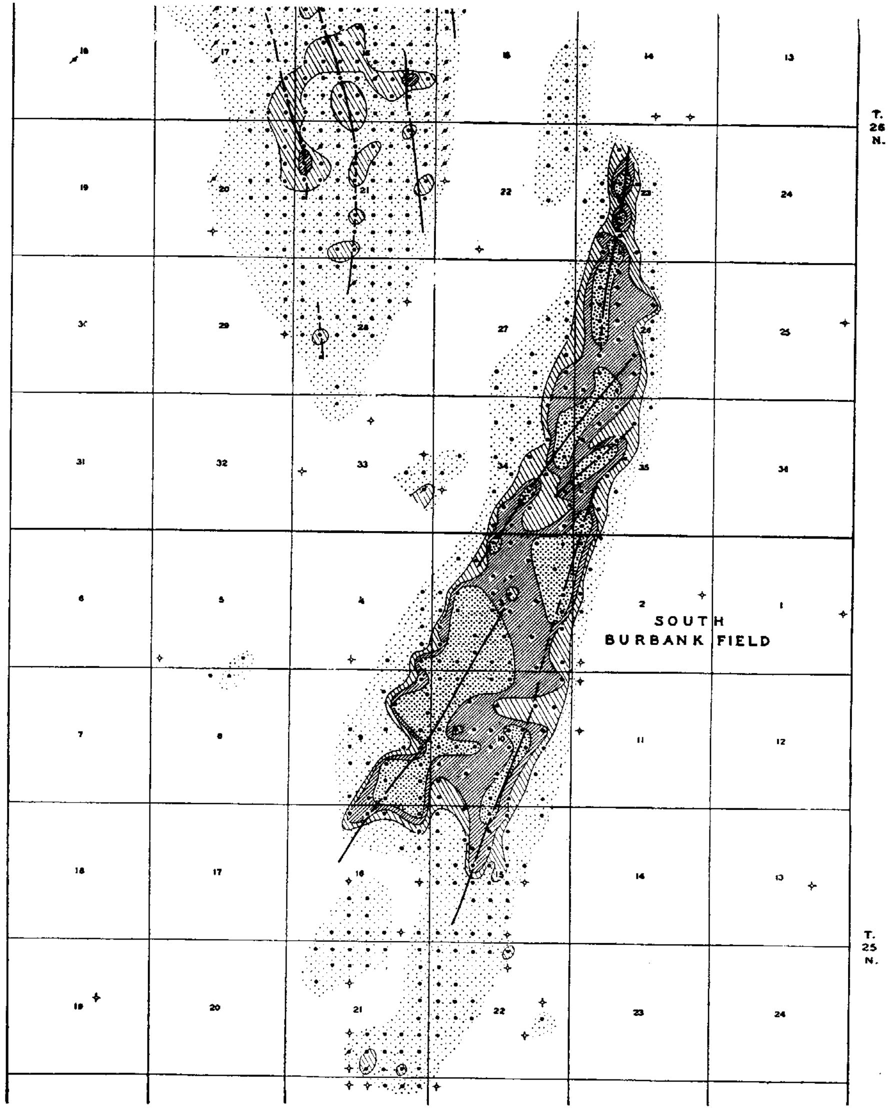


FIG. 1

fine-grained sediment of the adjacent deposits, but a longitudinal zone in the middle of a bar consists largely of well sorted clean sand. Such a zone would accordingly be the most highly permeable part of the sand bar. Oil wells with large initial yields in the Burbank and South Burbank fields obtain their oil from the more permeable parts of the reservoir sands; and the narrow zones containing such wells in these pools are believed to be the middle portions of many overlapping sand bars that collectively form the large sand bodies.

During the long time consumed in the deposition of the large sand body of the Burbank field doubtless the crests of many ridges were planed off by waves, wind, and rain and the swales between the ridges were filled. The surface relief on many of the bars that constitute the sand body was therefore destroyed, but the permeability and other features in the remaining portions of the bars were not affected.

The sand body of the Stanley stringer, as shown by its thickness and distribution, is a narrow bar-shaped body, extending southeastward continuously for many miles; but the alignment of the belts showing the initial daily yields of the wells indicates that this sand body really consists of a series of relatively short, closely associated sand bars that trend northwest across the main sand body and have an offset arrangement, like the offset arrangement of sand bars on most of our recent coasts.

The offset arrangement of the individual segments of the Stanley stringer sand body apparently has not been generally recognized, for the wells in Secs. 11 and 14, T. 26 N., R. 6 E., except those in the NW. ¼, NW. ¼ of Sec. 11, were drilled west of the southeastward-trending belt lying in the W. ½ of Sec. 11, and possibly extending into Sec. 14.

Application to repressuring.—The determination of the relative permeability of the reservoir sand body throughout an oil field is important in planning for repressuring the sand with gas or water. Such data are most likely to be acquired by laboratory permeability tests made of cores of the sand taken specifically for that purpose. Where such cores are unavailable, however, it is believed that a map such as Figure 1 will supply much information about the permeability of the sand that can be used in planning the repressuring project. The narrow belts containing wells whose initial daily yields have been large are believed to represent belts in which the sand has high permeability, and the belts containing wells whose initial daily yields were small are believed to represent belts in which the sand has relatively low permeability. The intake (or pressure) wells should be distributed along the belts in such a manner as to allow for the changes in permeability laterally from one belt to another rather than at equi-distant sites throughout the pool.

Inasmuch as the belts cross leased properties of different ownerships, any plan for locating intake wells along the belts would necessitate the coöperation of many owners. Some sort of a unit plan of operation for relatively large parts of the field, therefore, would be necessary to make such a plan practicable.

Recent results in water-flooding a shoestring sand body in the Cherokee shale near Chanute, Kansas, have shown that the flood water travels faster lengthwise the sand body than across it.[4] Inasmuch as the sand body at Chanute lies near the stratigraphic position of the Burbank sand and is believed to have been formed in a similar manner as the Burbank sand, the behavior of the water injected into the sand is noteworthy; it appears to bear out the contention that the most permeable parts of sands of this type lie in belts that trend lengthwise the sand bodies.

[4] W. R. Dillard, D. P. Oak, and N. W. Bass, "Chanute Oil Pool—a Water-Flooding Operation," *Stratigraphic Type Oil Fields* (Amer. Assoc. Petrol. Geol., in preparation, 1941).